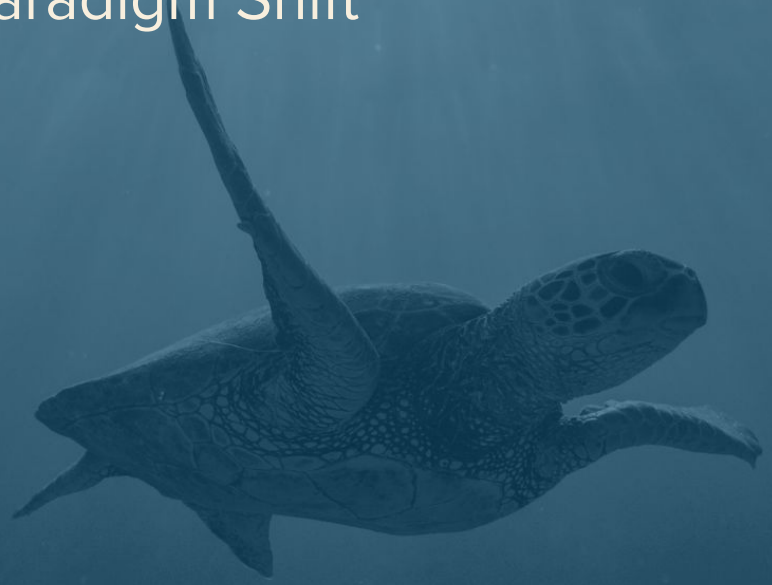
Harnessing AI to Transform Climate Action

Part I – A Paradigm Shift



Climate Collective

NOV
2023

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Introduction

It's time for climate-informed decision-making.

Climate change is a time game - and we're falling behind. We have already breached six of nine planetary boundaries. Average annual climate finance flows reached almost USD 1.3 trillion in 2021/2022, nearly doubling 2019/2020 levels but still falling short of the decarbonization investments needed to limit global warming in line with the Paris Agreement. It is increasingly clear that ensuring a livable planet for future generations - halting and reversing biodiversity loss - is deeply connected to meeting our climate targets. To accelerate progress toward climate and nature goals with limited resources and time requires dynamic decision-making and a more holistic approach that considers these interlinked systems and how they depend upon one another.

For the first time, data scarcity isn't the primary barrier to effective coordination; in fact, the world is inundated with data. Now, the challenge lies in interpreting and leveraging this abundance of information effectively. The question at hand is: How do we navigate through the myriad of potential shared socioeconomic pathways (SSPs) and identify the most impactful climate technologies, policies, solutions, and incentives?

The sheer volume of data available to climate decision makers today is overwhelming and growing exponentially with advances in technology and connectivity. At the same time, the computational tools and other knowledge needed to process and make sense of this data are not widely accessible, deepening the insight and opportunity divide.

Shared Socioeconomic Pathways (SSPs)

The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (2021-22) introduced a range of representative scenarios that consider how demographics, economics, technology, and society at large will continue to evolve over the coming century. These scenarios, known as the Shared Socioeconomic Pathways (SSPs), were developed by an international team of climate scientists, economists, and energy systems modellers to consider future events that could impact climate mitigation and adaptation efforts. While the IPCC's SSPs are broadly useful as future reference narratives, strategic leaders have begun to develop "custom SSPs" exploring relevant pathways for their own focus areas. Aligning stakeholders on these fine-grained narratives and their quantitative policy and business implications is one of the key challenges of collective action in the 21st century.

This gap is particularly stark between geographies, and the divide between the information “haves” and “have-nots” can translate into unoptimized policies that apply technologies poorly adapted to the context. To be clear, the complexity of the problem extends beyond the capacity of any single individual or organization to fully grasp or tackle. As such, corporate executives, investors, and policymakers still diverge significantly on the urgency, size, and scope of climate action.

Institutions such as markets, industry bodies, and quality assurance standards can play a central role in helping individuals and organizations coordinate on solutions to collective challenges. Climate markets are still in their early development and institutions and regulations are at different stages of maturity across geographies and jurisdictions. As these evolve, strengthening the transparency and integrity of these institutions will be critical to ensure they have the public trust and credibility needed to be effective. For example, recent concerns around the lack of integrity of current carbon markets and net-zero corporate commitments have resulted in a slow-down of climate investments and carbon credit retirements.

The immense complexity of the climate and nature challenges we face, combined with the nascency of coordinating institutions, leads to inefficiencies and ambiguity. This hinders everyone’s ability to develop coordinated, focused strategies or adequately evaluate investments - businesses, communities, and governments alike. Indeed, for every potential climate solution – whether it is nuclear power, bioenergy with carbon capture and storage (BECCS), direct air capture of carbon (DAC), or even a seemingly uncontroversial activity such as tree planting – there is significant controversy, both in the public discourse and among experts themselves. This further highlights the need for nuanced approaches that take into account not just the science and evidence, but the trade-offs, preferences, and lived experiences of all stakeholders.

To overcome these challenges, we need a new generation of tools and infrastructure for climate-informed decision-making. These new technologies must leverage our collective strengths to bridge data gaps and unlock new insights and strategies. Developing these augmented capabilities will require a concerted effort from all stakeholders - investors, corporations, governments, and communities.

Together, we can transform the tide of climate action, turning data into actionable insights that drive real change. Solving this sensemaking problem is more than just an economic opportunity; it's a moral imperative to safeguard our planet for future generations.

The Role of AI

Harnessing the power of Artificial Intelligence (AI) to mitigate climate change and nature degradation offers a unique opportunity for society to accelerate progress towards nature and climate goals. AI offers immense potential — it can expedite progress towards net-zero targets, help restore data integrity and trust in carbon markets, simplify compliance reporting of nature and climate related financial disclosures, and enhance the accuracy and speed of evaluating environmental interventions.

To deploy climate solutions effectively across various markets and geographies, we need to amplify and wisely direct our investments in climate technology to increase the accessibility and affordability of these solutions. This includes not just the technologies themselves, but the entire suite of processes and policies – from digital transformation to upskilling – required to make them work in various local contexts. That, in turn, requires clear, rapid feedback mechanisms to identify what works and what doesn't. AI stands out as a pivotal tool in this regard, at its best offering a sophisticated, transparent, and continuously updated source of knowledge and insight. It can play key roles in streamlining the evaluation of potential solutions, fostering insight-gathering on various projects, recommending adjustments to practitioners, and unearthing and promoting local expertise. Powerful examples of this are starting to arise in fields such as agroecology and environmental conservation, as demonstrated by leading organizations like Savimbo and the Allen Institute's EarthRanger program.

So how does AI deliver all these benefits? AI models incorporate knowledge about how the world works, whether explicitly provided by experts or gleaned from correlations in historical data. After being "trained" this way, AI models can then ingest data streams describing the current state of the world, to provide intelligence in the form of inferences, predictions, and recommendations. Ultimately, this intelligence is used by humans to make more informed decisions and strategies. (This includes automated processes, wherein decision makers choose to accept the AI's recommendations by default.) The outcomes resulting from those decisions produce more data, from which better intelligence can be produced, and the cycle continues.

It's helpful to think about intelligence as having three uses:

1. **Inference**: To determine what has happened and understand what is happening.
2. **Prediction**: To forecast what will happen.
3. **Counterfactuals**: To imagine what would happen if some action was taken.

Uses of Artificial Intelligence (AI) to Enhance Climate Decision-Making

The cases listed below are not exhaustive and are intended to illustrate the potential utilization of AI across areas of climate action.

Area of Inquiry	Uses of Intelligence		
	Inference *(What has happened?)*	**Prediction** *(What will happen?)*	**Counterfactuals** *(What would happen?)*
CO_2 Sequestration	How much CO_2 has this forest sequestered?	How much CO_2 will this forest sequester by 2025?	How much CO_2 would this forest have sequestered had we planted a different species?
Climate Finance	Why do investors buy green bonds today?	Will green bond purchasing behavior change in the coming decade?	If the premium for a green bond increased by 1%, how much would demand change?
Identifying & Scaling Effective Climate Action	Which projects are getting anomalously good results?	How does that affect our projections for it and other projects?	Can we replicate these results by applying these practices to other projects?
Energy Provision	How much energy was used for HVAC in the previous decade?	What HVAC energy needs can we expect for next decade?	If passive cooling units were cheaper, how much HVAC energy would we need?

AI can be applied to tackle nature and climate challenges by enhancing all of these aspects of intelligence.

We will explore some examples in Part II of this series.

In light of these exponential improvements, it's important to remember that, on their own, AI models don't automatically deliver solutions. Put differently, more technology does not immediately equate to better outcomes. Here are some of the most critical pitfalls and risks to avoid.

- **Avoiding overconfidence:** The usage of technology can sometimes cause unjustified confidence, which can later cause mistakes and loss of trust. In particular, many of today's most popular AI models can't deal with uncertainty, can't distinguish between fictitious and real information, and tend to confuse correlation with causation. These and other limitations can lead them to provide "intelligence" that is confidently wrong (a particularly frequent problem in the so-called "hallucinations" produced by large language models such as ChatGPT).
- **Preventing concentration of power:** AI can exacerbate power imbalances by centralizing control in the hands of a few tech giants and governments, raising risks of exploitation and cybersecurity threats.
- **Mitigating unintended consequences:** AI can lead to unintended outcomes through its suggestions and influence on users. It can become a crutch, undermining the autonomy of decision makers, with particularly dangerous consequences in mission-critical applications such as driving.
- **Addressing equity and justice:** AI systems tend to bias toward the data they're trained on, potentially at the expense of local and indigenous knowledge, which is especially important to nature restoration and the protection of biodiversity hotspots.

Takeaways

With these opportunities and risks in mind, a handful of themes and approaches that guide a more responsive use of AI are emerging in the context of AI for climate and nature solutions.

1. Universal Representation and Accessibility

Ensure AI system design and data sources adequately represent the knowledge and needs of all stakeholders; for instance, they should include not only scientific knowledge but indigenous knowledge, as well. Further, ensure these resources are meaningfully accessible to a broad group of stakeholders. This task is increasingly feasible across diverse geographies and languages with the advent of universal translation services and conversational interfaces.

2. Transparency: Embrace Open Data

Encourage and invest in platforms that prioritize open data sharing, especially when this data is used to make high-stakes decisions. This transparency is crucial for collaborative progress and innovation for climate solutions.

3. Diversity of Approaches: Bet on Multiple Horses

The future of climate solutions is uncertain, and betting on any single approach may be risky. Support a wide range of startups and initiatives, as it's hard to predict which solutions will be most effective in the long run. However, care must be taken to integrate these bets into a coherent strategic thesis, as shown in the "tech tree" framework.

4. Coherence and Interoperability: Build Open Platforms and Protocols

Invest in systems that promote interoperability and coherence. Open platforms and protocols will ensure that various solutions can work together seamlessly, enhancing the overall effectiveness of our collective efforts.

5. Explainability and Defensibility of AI Systems

Back ventures that not only develop AI solutions but also prioritize making these systems explainable, causal, scientifically grounded, and reproducible. It's vital that AI-powered decision-making processes are transparent and can be justified, especially in scenarios with significant environmental and societal impacts.

6. Keep Humans-in-the-Loop

"Human-in-the-loop" is a design and deployment paradigm wherein AI systems are designed to work in concert with human expertise. This collaboration ensures that AI deployment is grounded in human values, discernment, and practical realities, reducing the risk associated with attempting to encode those ambiguous and shifting concerns into computer-friendly logic.

7. Pursue Rigorous Systems Thinking

While there is no one-size-fits-all checklist for good AI climate deployments, it is possible to gain confidence through thoughtful consideration of a proposed solution in the context of the whole system's behavior. Such exercises should be carried out in partnership with a diverse group of stakeholders and experts, and ideally will be structured using time-honored practices such as "red-teaming" and its variants, as well as "premortems".

Partnerships for Impact

Within the Sustainable Development Goals framework there is a specific goal dedicated to “how” to deliver on these objectives, with partnership taking a central role. With all of the complexity and nuances surrounding the level of societal transformation that is needed to advance climate and nature goals, partnership is a foundational strategy for success.

Climate Collective, a leading community of entrepreneurs, investors, non-profits and scientists leveraging digital technology (i.e. AI, blockchain, geospatial, etc.) for climate and nature action at scale, is building out a number of strategic partnerships to this effect. As part of our ecosystem services supporting early stage climate and nature tech companies we are developing dedicated technical resources and community services for AI-focused start-ups. Partnering with ecosystem actors like Climate Collective can help mitigate systemic risks and foster a more cohesive approach to climate action.

If you’re interested in working with Climate Collective to build out pilot projects, collaborate across specific climate or nature verticals, or engage with our community of climate and nature tech leaders, reach out to our team.

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